Human Cognition in Future Maintenance Operations

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- Understanding Human cognition
- Human-System Interaction
- Correlation between HSI and human cognition
- The usual process
- Metaverse – The future?
- Industrial Metaverse
- Architecture of Metaverse
- HSI in the metaverse
- Developed taxonomy
- Conclusions

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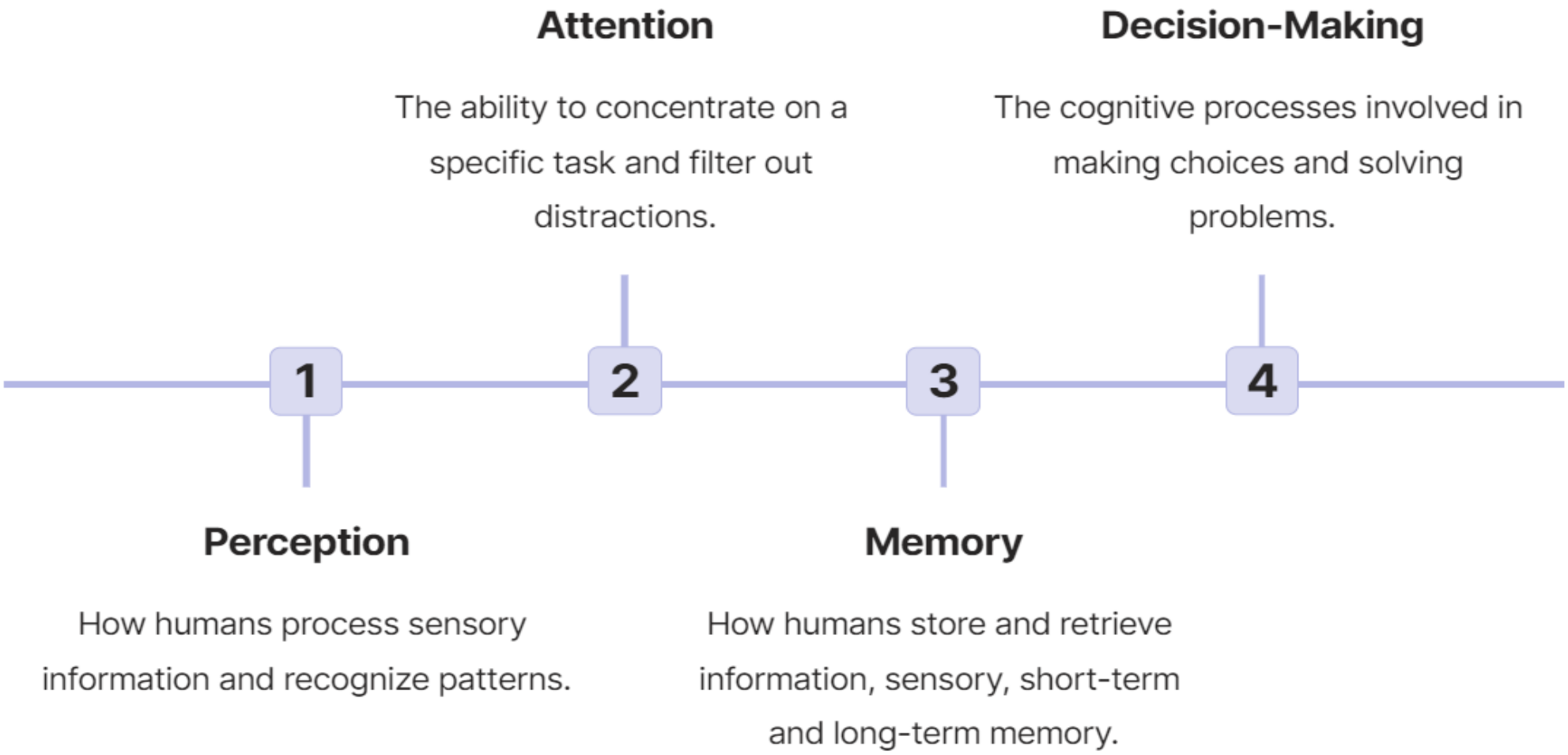
Understanding Human Cognition



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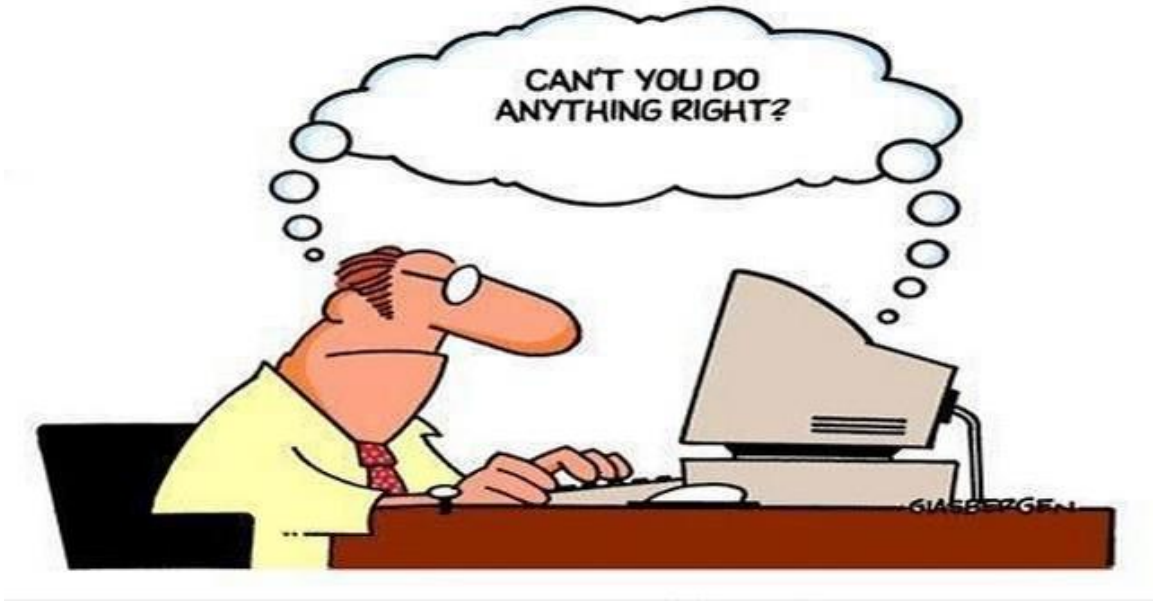
Human-System Interaction (HSI)

- A multidisciplinary field combining aspects of computer science, human factors, cognitive psychology, sociology, and engineering.
- Focuses on the design and development of systems that interact with humans.



The correlation between HSI and human cognition

1. Perception and Attention
2. Problem Solving and Decision Making
3. Learning and Adaptation
4. Cognitive Load
5. Feedback and Error Handling
6. User Experience

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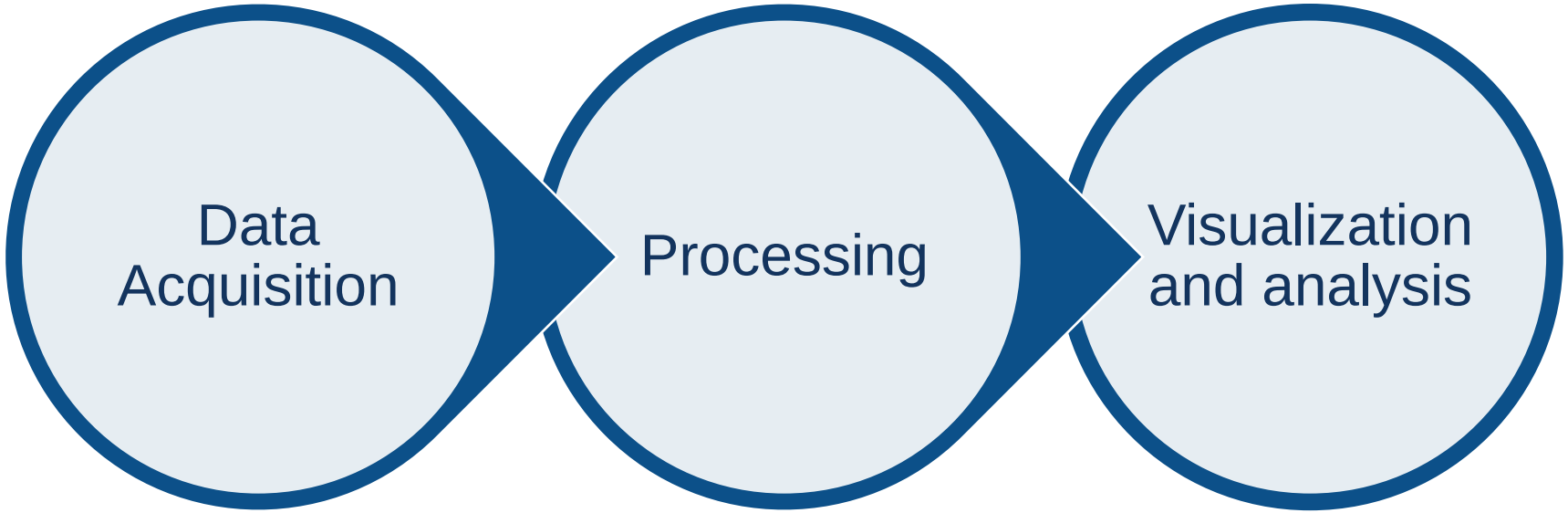
The usual process



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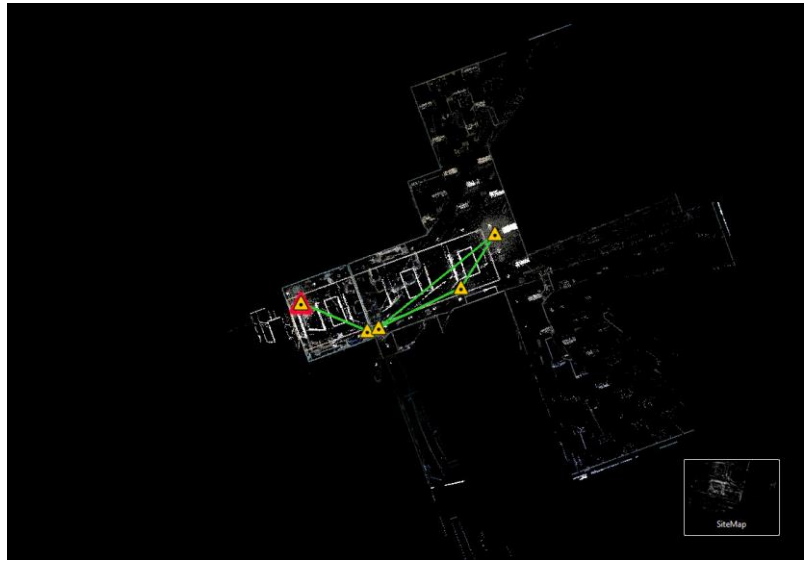

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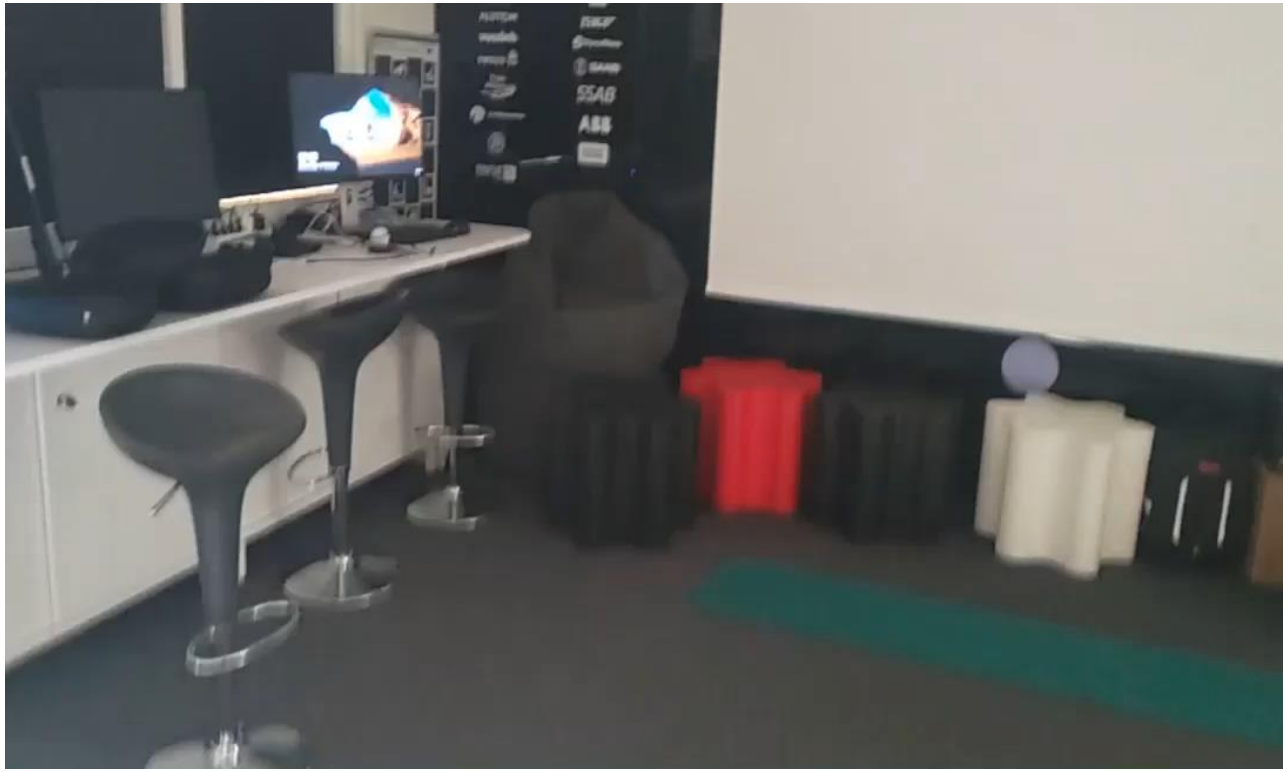
Metaverse - The future?

- Concept of a digital world facilitated by technologies like AI, Virtual Reality (VR), Augmented Reality (AR) and more.
- Term coined by Neal Stephenson in his novel, Snow Crash (1992). His work described it as a computer-generated and imaginary universe.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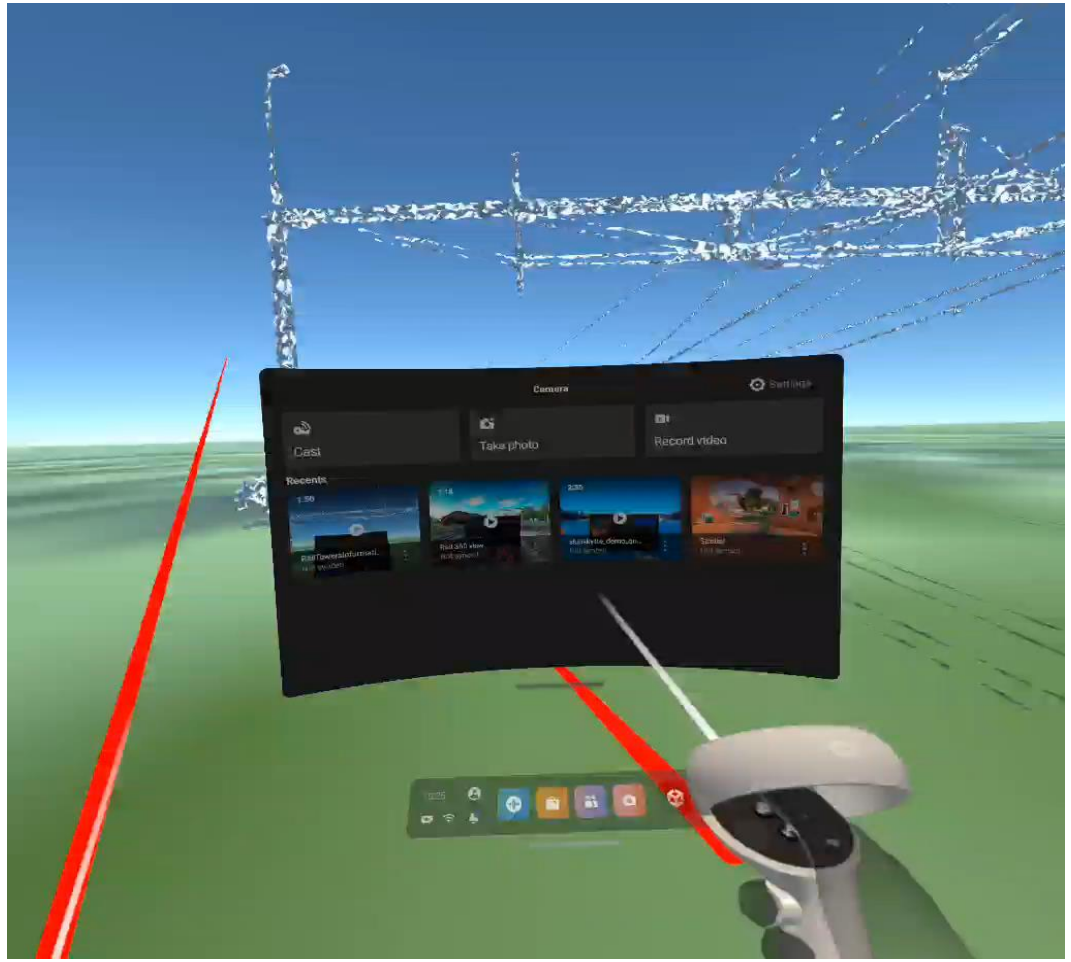

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Industrial Metaverse

- The integration of digital technologies, data analytics, connectivity, and automation into industrial processes, systems, and environments.
- Encompasses advanced technologies like IIoT, AI, ML, VR, and AR.
- Aims to transform traditional industrial practices to optimize efficiency, enhance safety and decision-making.

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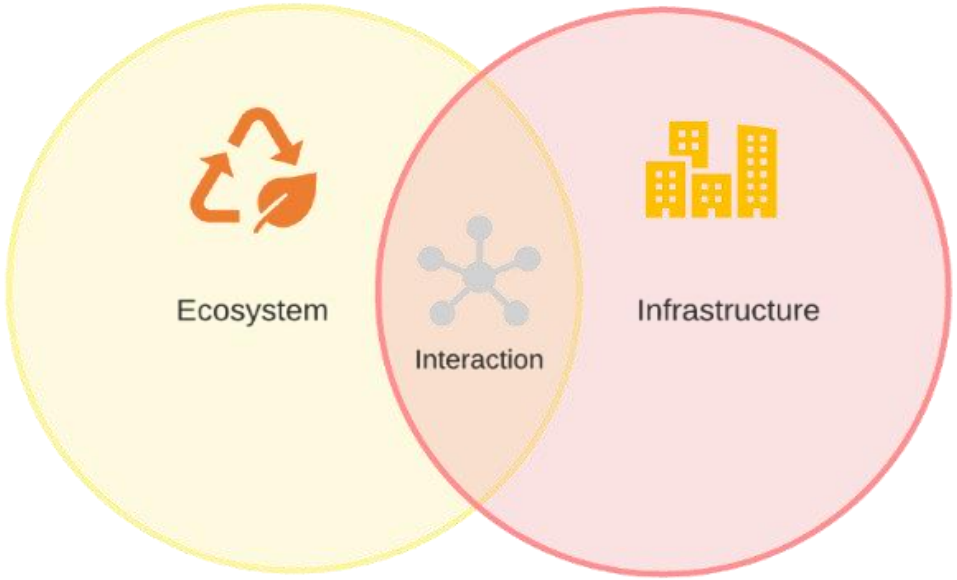
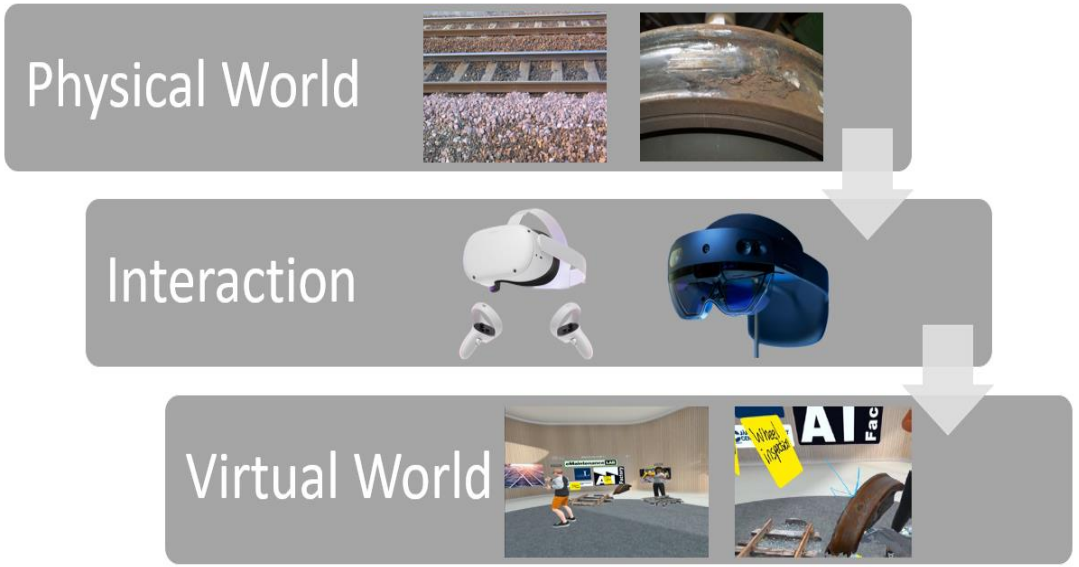
Architecture of the Metaverse



Metaverse from a macro perspective



Industrial Metaverse in Railways Context

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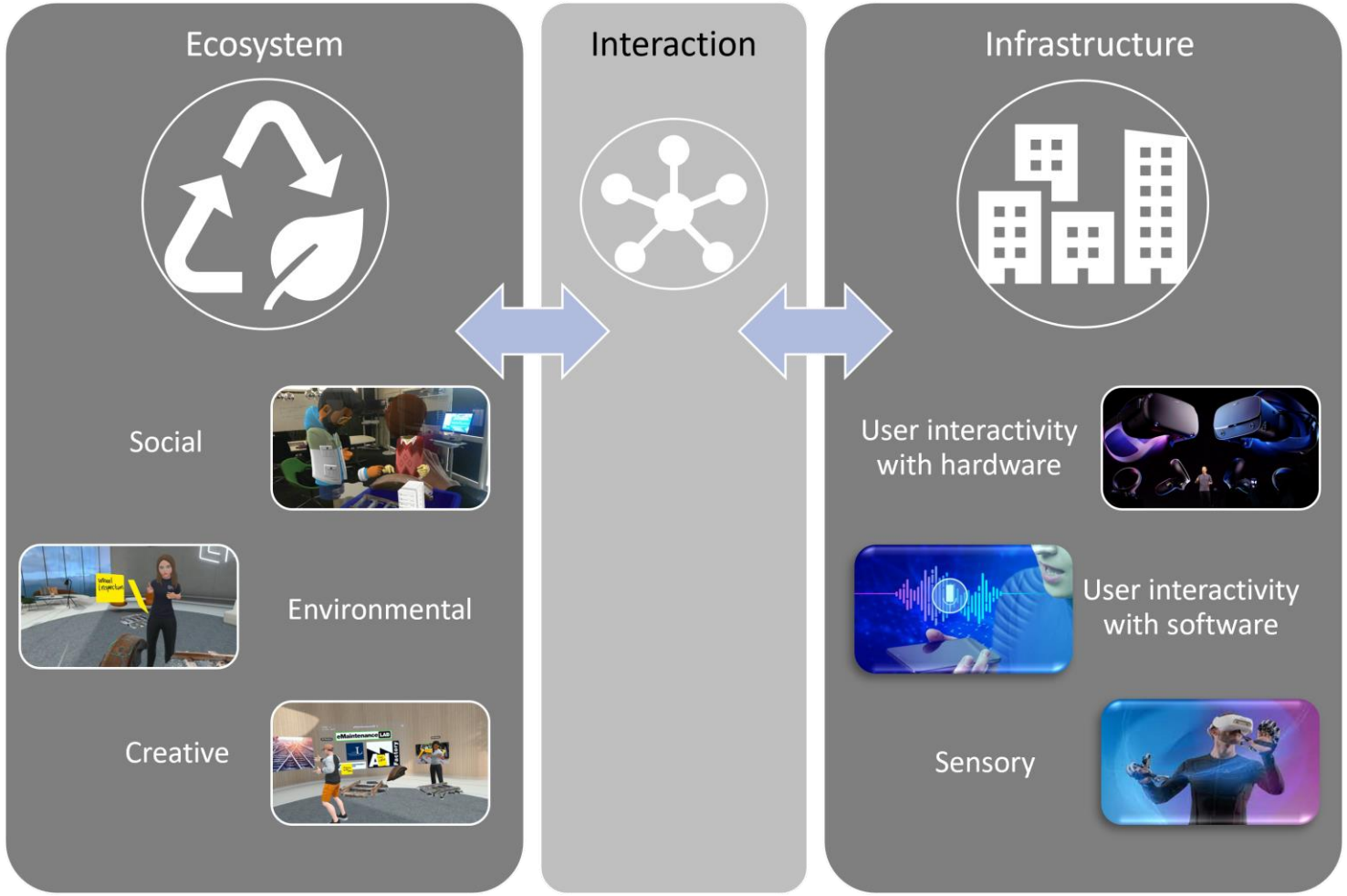
HSI in Metaverse



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Developed Taxonomy

Taxonomy of issues and challenges in the Metaverse from the HSI perspective in industrial contexts

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Technical Challenges

Integration of Multiple Technologies

Multi-platform and cross-platform compatibilities

Big Data

Security and Privacy

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Organizational Challenges

System Complexity

Integrating with Legacy System

Safety and Risk Management

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Economical Challenges

Realistic experience

Hardware and Devices

Ergonomical Challenges

User Comfort

Accessibility and Inclusivity

User Adaptability and Acceptance

Cognitive Load and information overload

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Conclusions

- Metaverse is expected to be integral in industrial asset management and sustainable operation and maintenance.
- Additionally, Metaverse integrated with AI and digital technologies will augment human perception, facilitating HSI.
- The traditional HSI techniques carry some limitations regarding usability, immersiveness, and connectivity when applied to the metaverse in the industrial context.
- The taxonomy will help gain deeper insight into requirements for a better interactive and immersive virtual environment.
- It can be used to assess the technology readiness level in the industry for the adaptation of the metaverse technology.

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